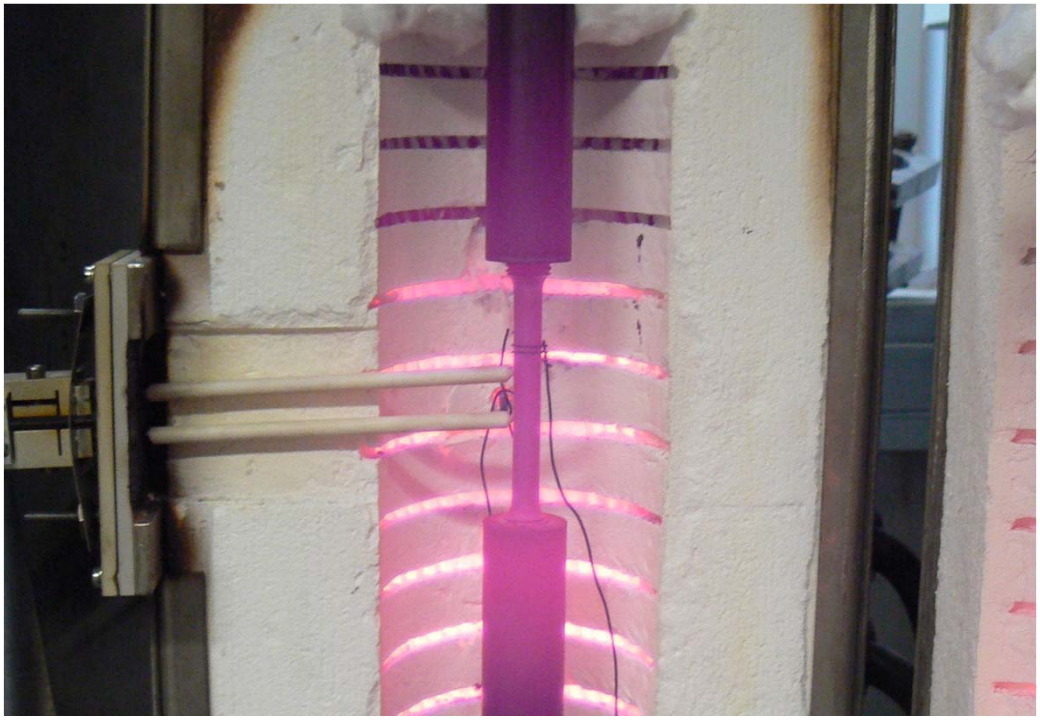
TECHNISCHE UNIVERSITÄT DARMSTADT

# Material and Creep Behaviour of S460 in Case of Fire

## Experimental Investigation and Analytical Modelling

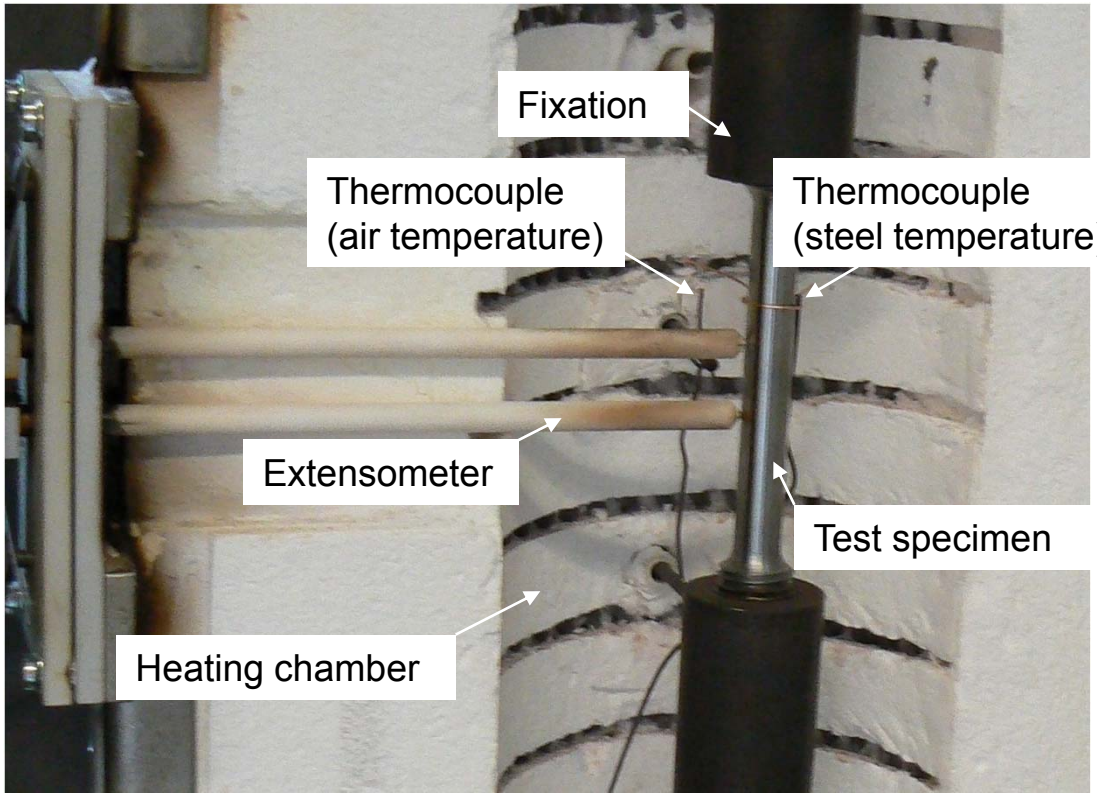
**Jörg Lange | Regine Schneider**



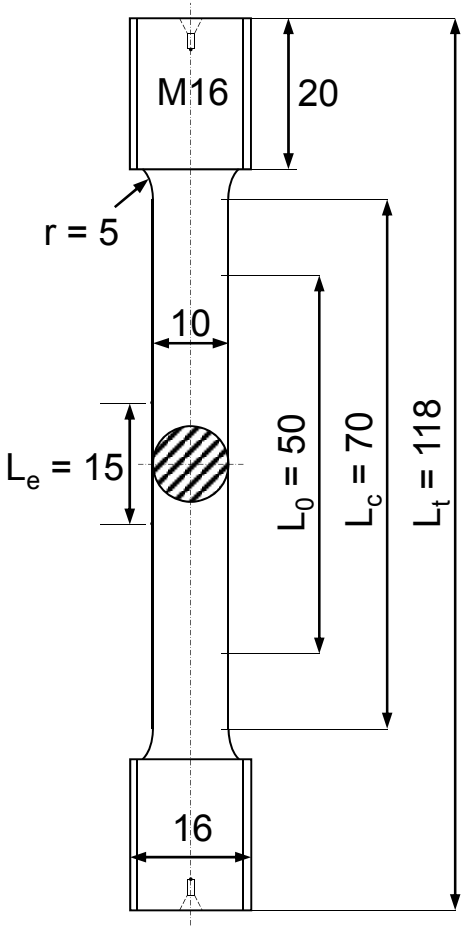
# Experimental Set-up

TECHNISCHE UNIVERSITÄT DARMSTADT

## Testing device




## Test specimen [mm]



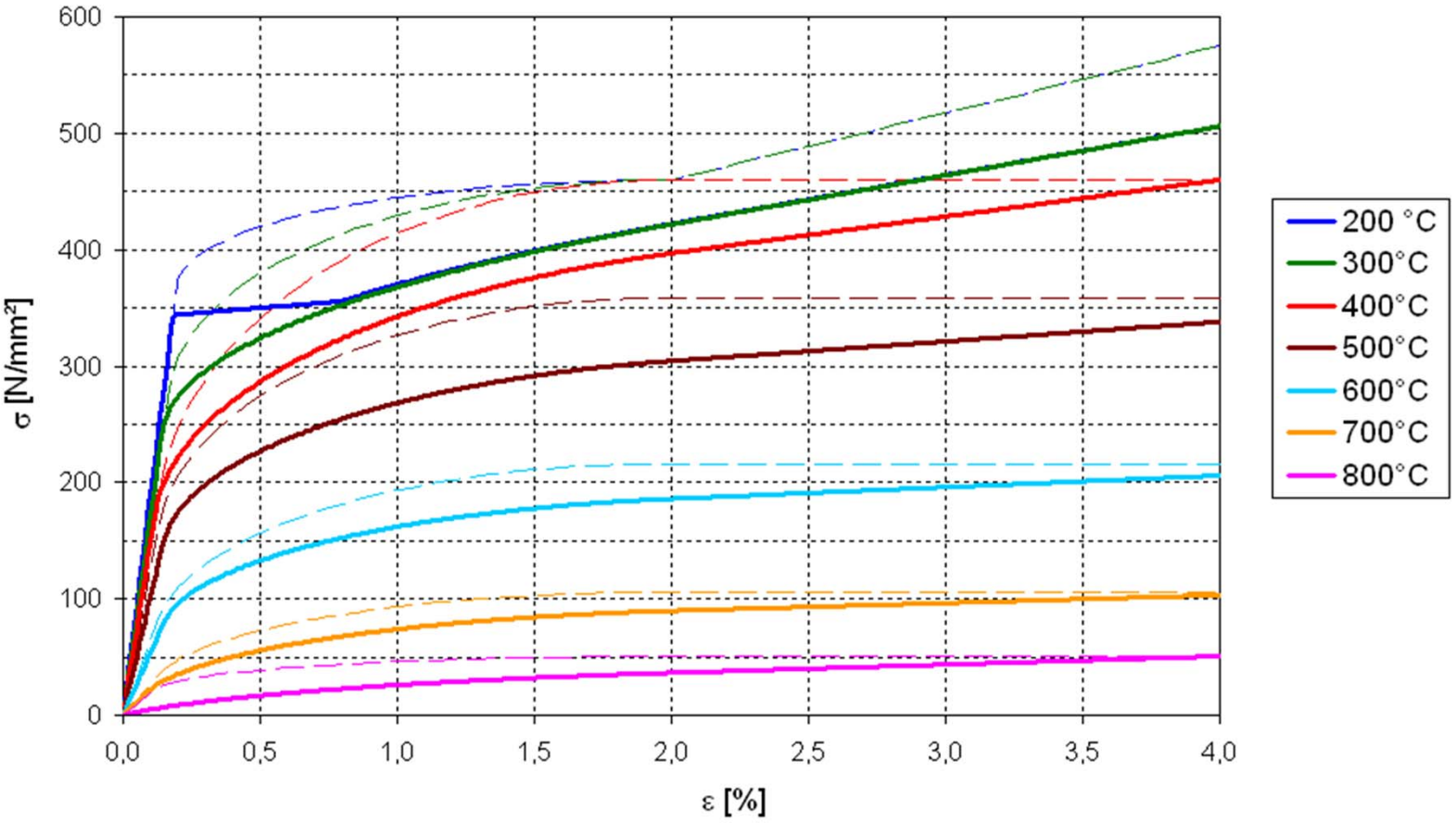



IFSW

# Test Results - Comparison with EC3-1-2

TECHNISCHE UNIVERSITÄT DARMSTADT

## Constitutive equations - S460N



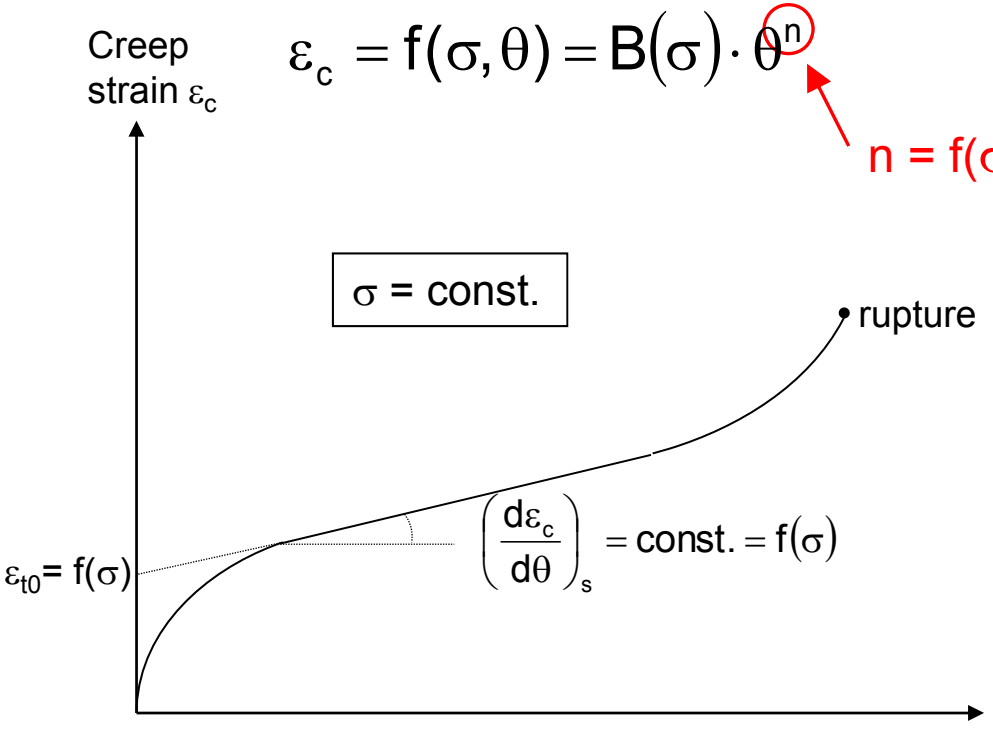



IFSW

# Empirical Creep Law for S460

TECHNISCHE UNIVERSITÄT DARMSTADT

Creep of metal at elevated temperatures  Creep law with variable exponent n = f(σ,θ)




$$\varepsilon_c = B(\sigma)\cdot\theta^{a(\sigma)\cdot\theta+\frac{1}{3}} \quad [\%]$$

$$\theta = \int e^{\frac{-\Delta H}{RT(t)}} dt$$

where $\Delta H$ Activation energy of creep [J/mol]

R Gas constant [J/mol K]

T Temperature [K]

t Time [h]

**Material M1:**

$$B(\sigma) = \begin{cases} 803\cdot\sigma & \text{für } \sigma < 0{,}08\ f_{yk} \\ 15300\cdot e^{0{,}01789\cdot\sigma} & \text{für } \sigma \geq 0{,}08\ f_{yk} \end{cases}$$

$$a(\sigma) = \begin{cases} -2{,}48\cdot10^{6}\cdot\sigma^{4{,}586} & \text{für } \sigma < 0{,}4\ f_{yk} \\ -1{,}8\cdot10^{13}\cdot e^{0{,}0442\cdot\sigma} & \text{für } \sigma \geq 0{,}4\ f_{yk} \end{cases}$$

Creep law with n = f(σ,θ): Inflection point!  Any variable temperature profile can be trea

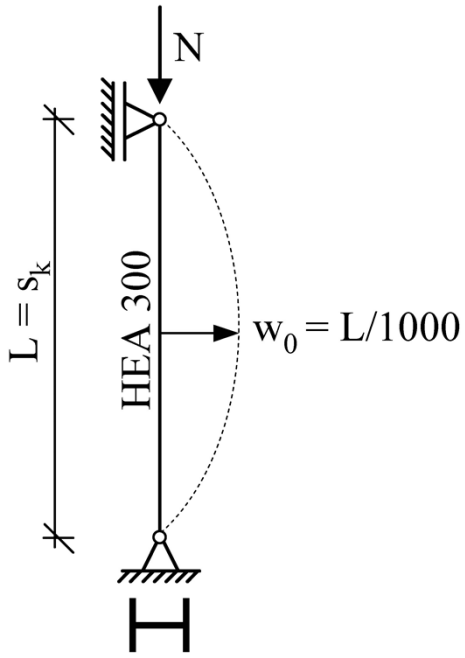
**Materials M2, N2:** slightly different values

# Load-carrying Capacity of Structural Members

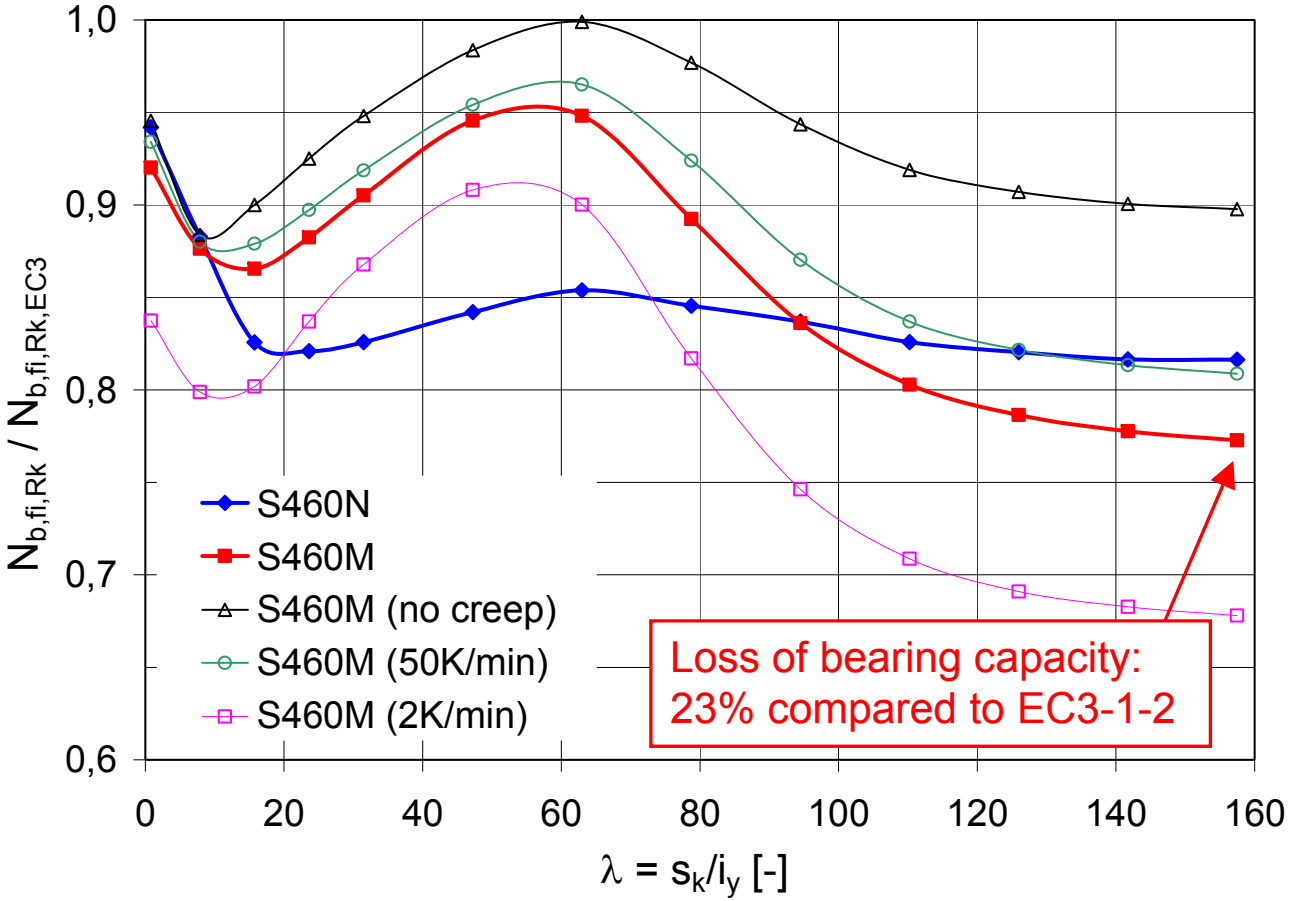
TECHNISCHE UNIVERSITÄT DARMSTADT

## System

T = 500 °C




## Load-carrying capacity compared to EC3-1-2






IFSW

# Material and Creep Behaviour of S460 in Case of Fire

## Experimental Investigation and Analytical Modelling

**Jörg Lange | Regine Schneider**

TECHNISCHE UNIVERSITÄT DARMSTADT

Thank you very much for your attention!